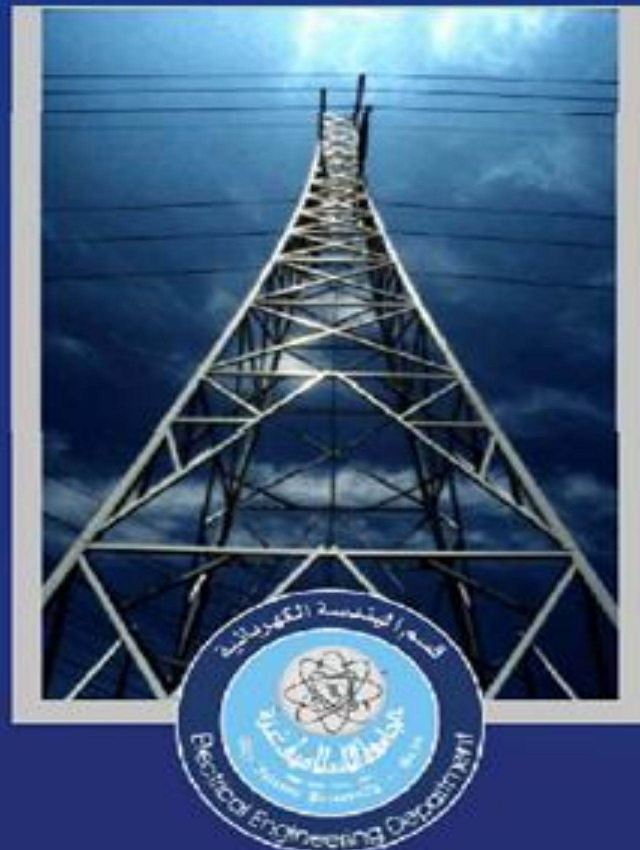
THE ISLAMIC UNIVERSITY OF GAZA



ELECTRICAL DEPARTMENT

Engineering Faculty

بسم الله الرحمن الرحيم

Islamic university –Gaza

Electrical Engineering

Electronic II Lab

Experiment: 1

Multistage Amplifier: Part 1

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Fall-2011

•Application of BJT:

(1) Amplification (linear mode)

(2) Switching (cutoff-saturation region)

(3) Isolation

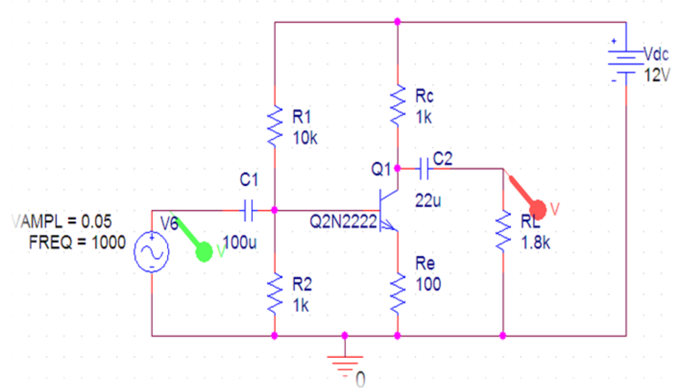
(isolate small current circuit from large current circuit)

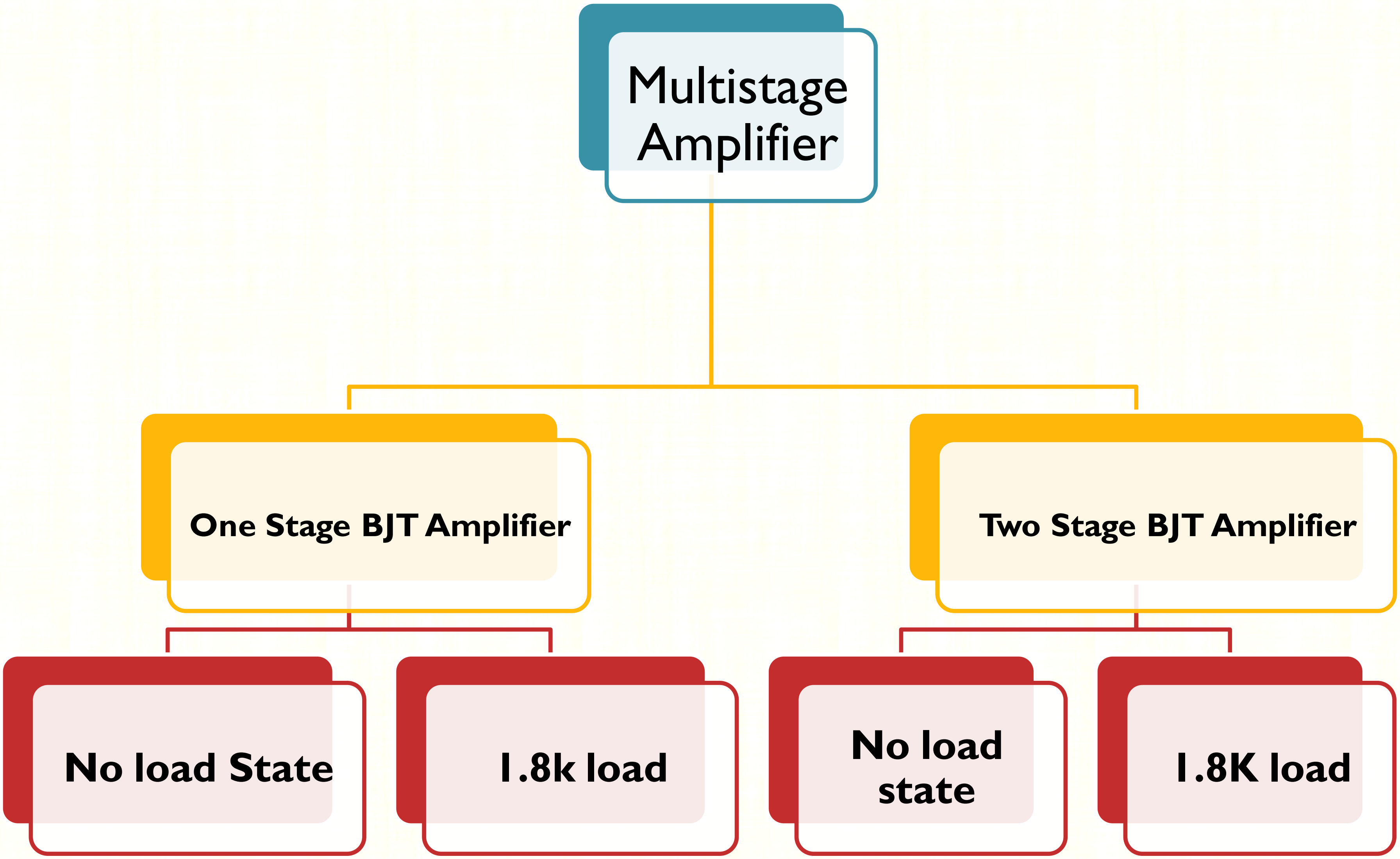
•Steps of Amplification:

(1) Biasing (applying DC voltage)

- To activate Transistor
- To get Linear mode

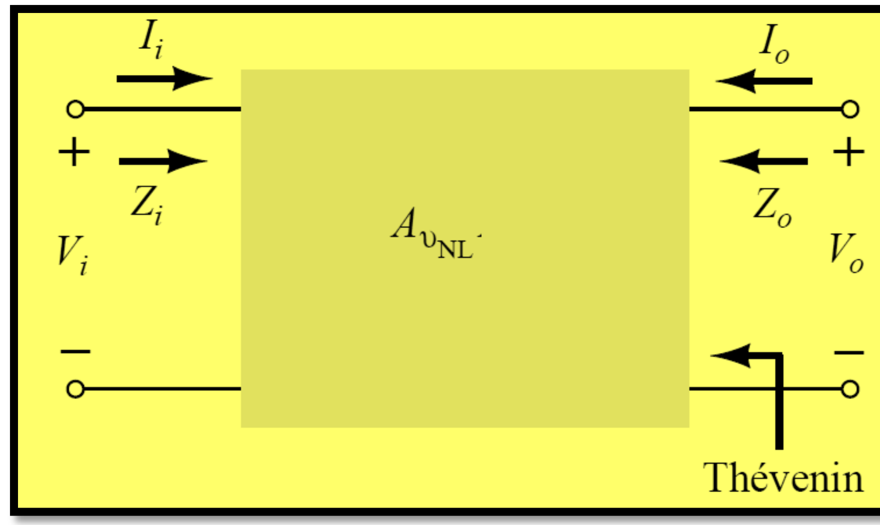
(2) Applying input AC signal





Multistage Amplifier
One Stage BJT Amplifier
Two Stage BJT Amplifier
No load State
1.8k load
No load state
1.8K load

Two port system

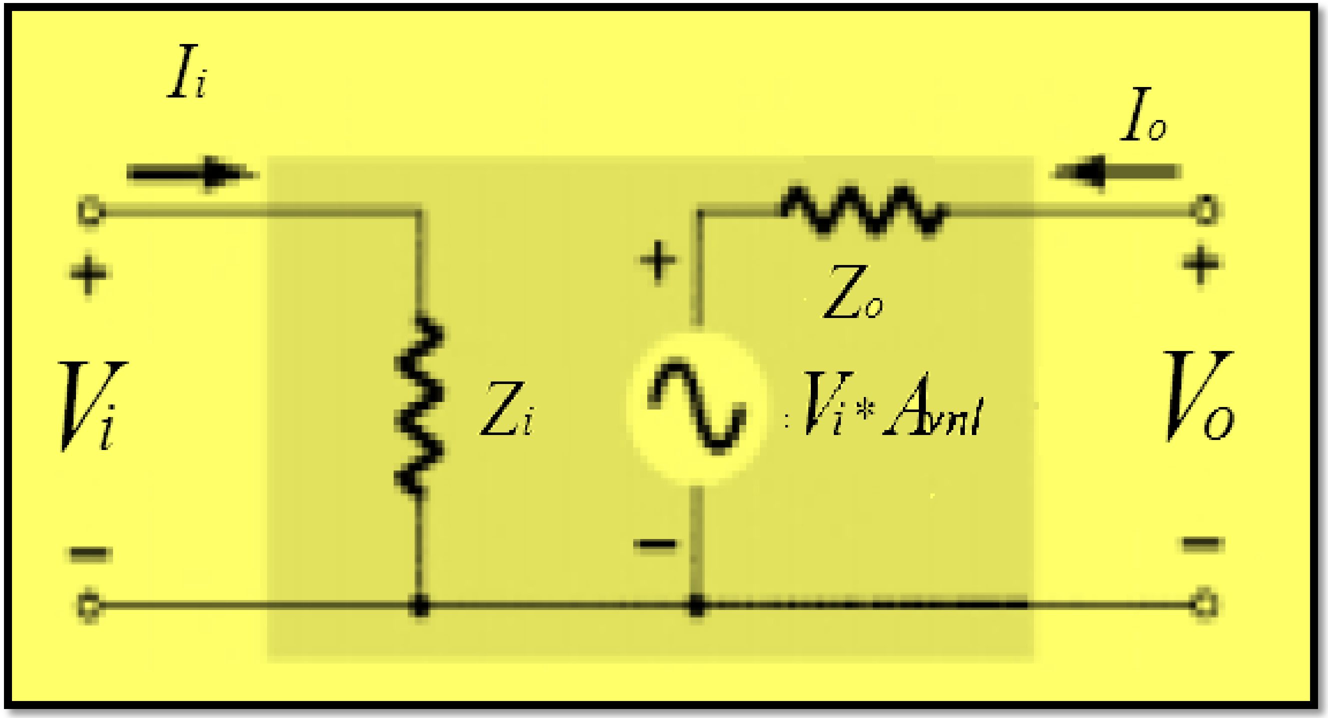


$$A_{vnl} = \frac{V_o}{V_i}$$

$$V_o = V_i * A_{vnl} = E_{th}$$

$$V_i = I_i * Z_{in}$$

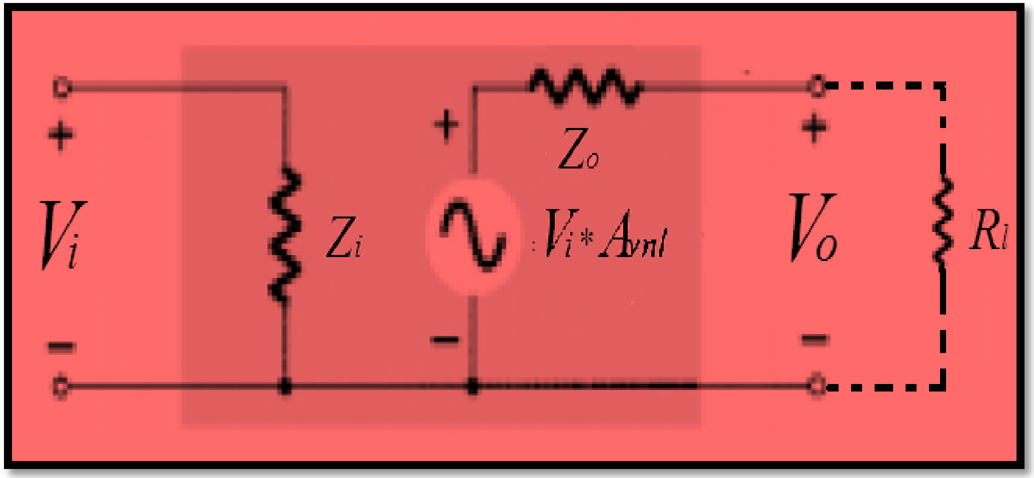
❑ No Load State



$$V_o = V_i * A_{vnl}$$

$$V_i = I_i * Z_{in}$$

❑ With RL Load



$$V_o\big|_{voltage divider} = \frac{R_l}{R_l + Z_o} * V_i \cdot A_{vnl}$$

$$\frac{V_o}{V_i} = \frac{R_l}{R_l + Z_o} * A_{vnl} = A_{vloaded}$$

$$\boxed{A_{vloaded} = \frac{R_l}{R_{l+}Z_o} * A_{vnl}}$$

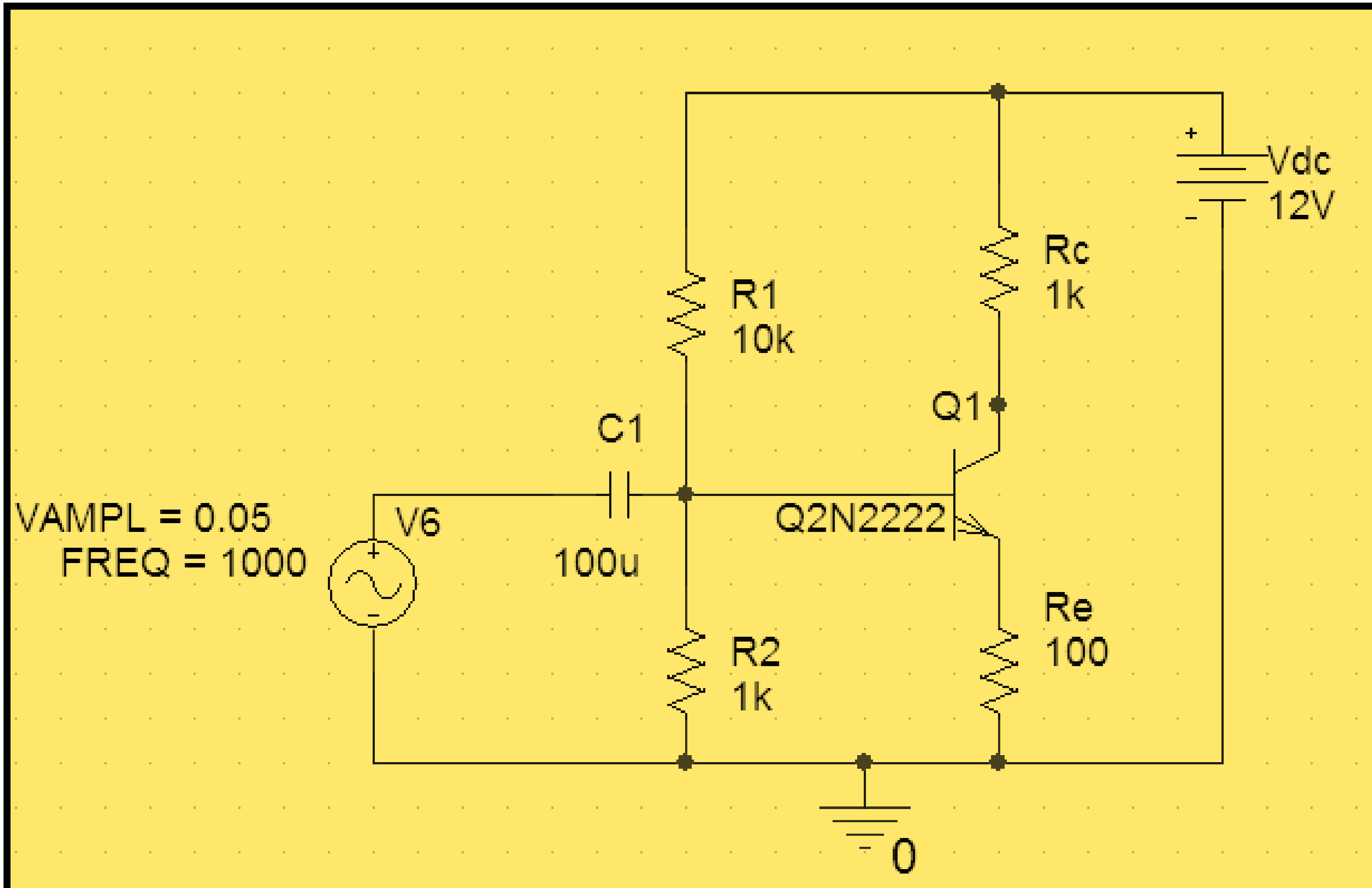
$Note:$

$*** \; A_{vnl} > A_{vloaded}$

$*** \; Zo = Rc(\,from \quad re \quad \mathrm{model})$

Part One: One stage BJT Amplifier

No load state



Results:

[1] Calculation:

From re model

$$A_{nl} = -\frac{\mathrm{Rc}}{\mathrm{Re}} = -10$$

Results:

[2] Practical:

(A) Using Multimeter to measure Vi & Vo

$$Avnl = \frac{Vo}{Vi} = ?$$

(B) Using Oscilloscope to display Vi & Vo

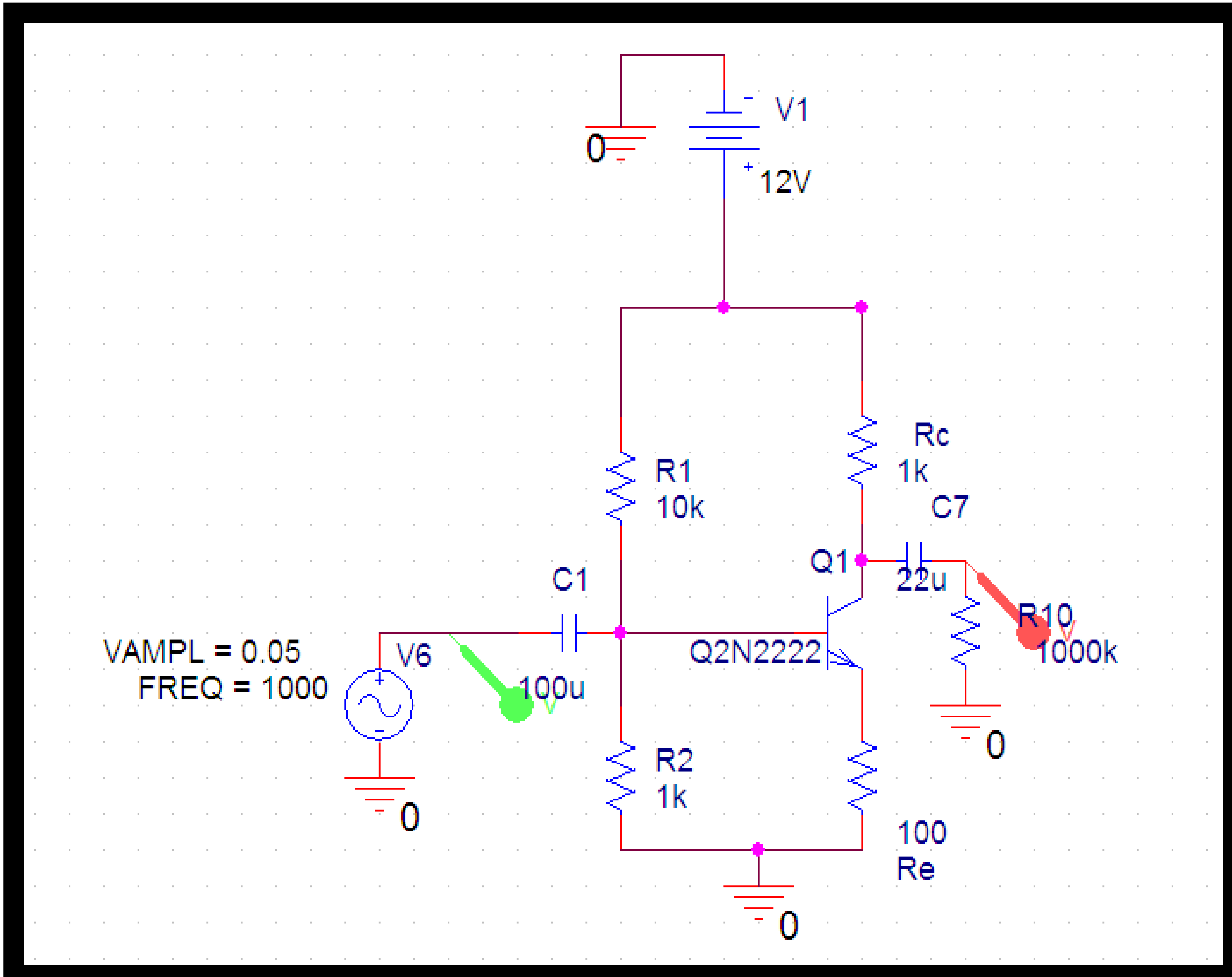
Results:

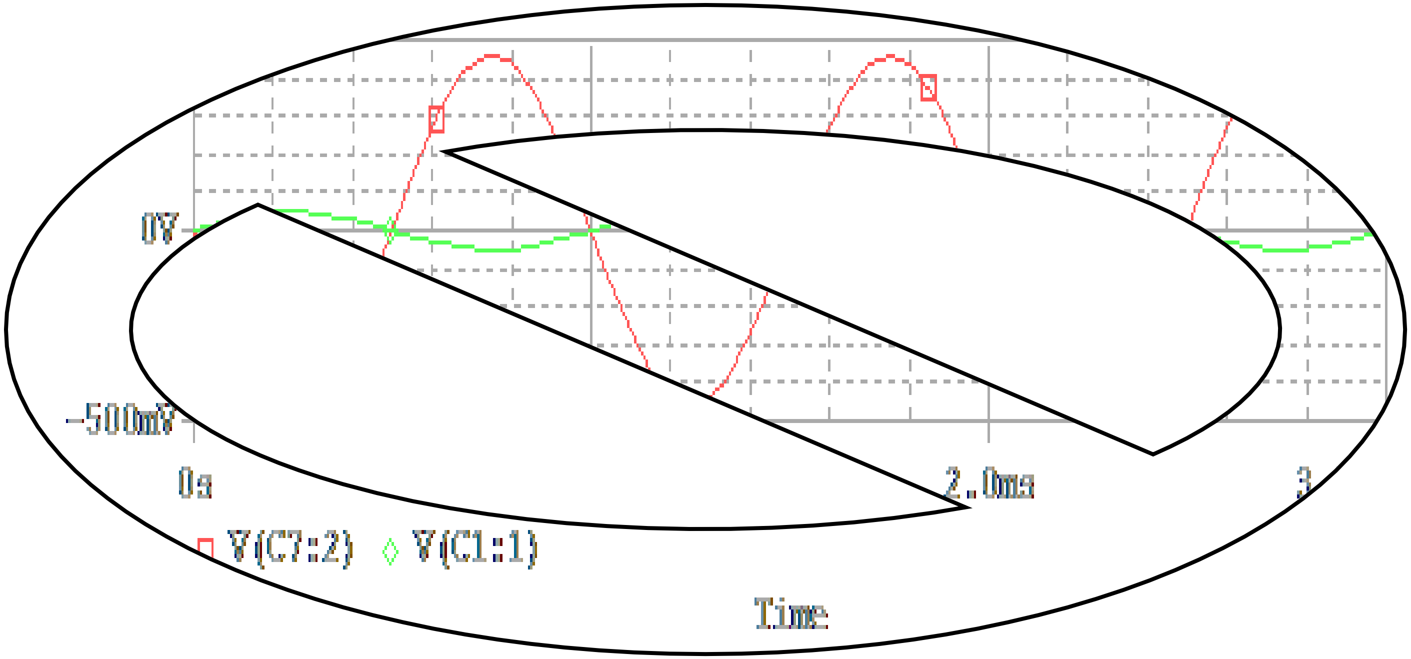
[3] Simulation (Orcad 9):

$$A_{vloaded} = \frac{R_l}{R_{l+}Z_o} * A_{vnl}$$

when R_L is very high ~1000kΩ

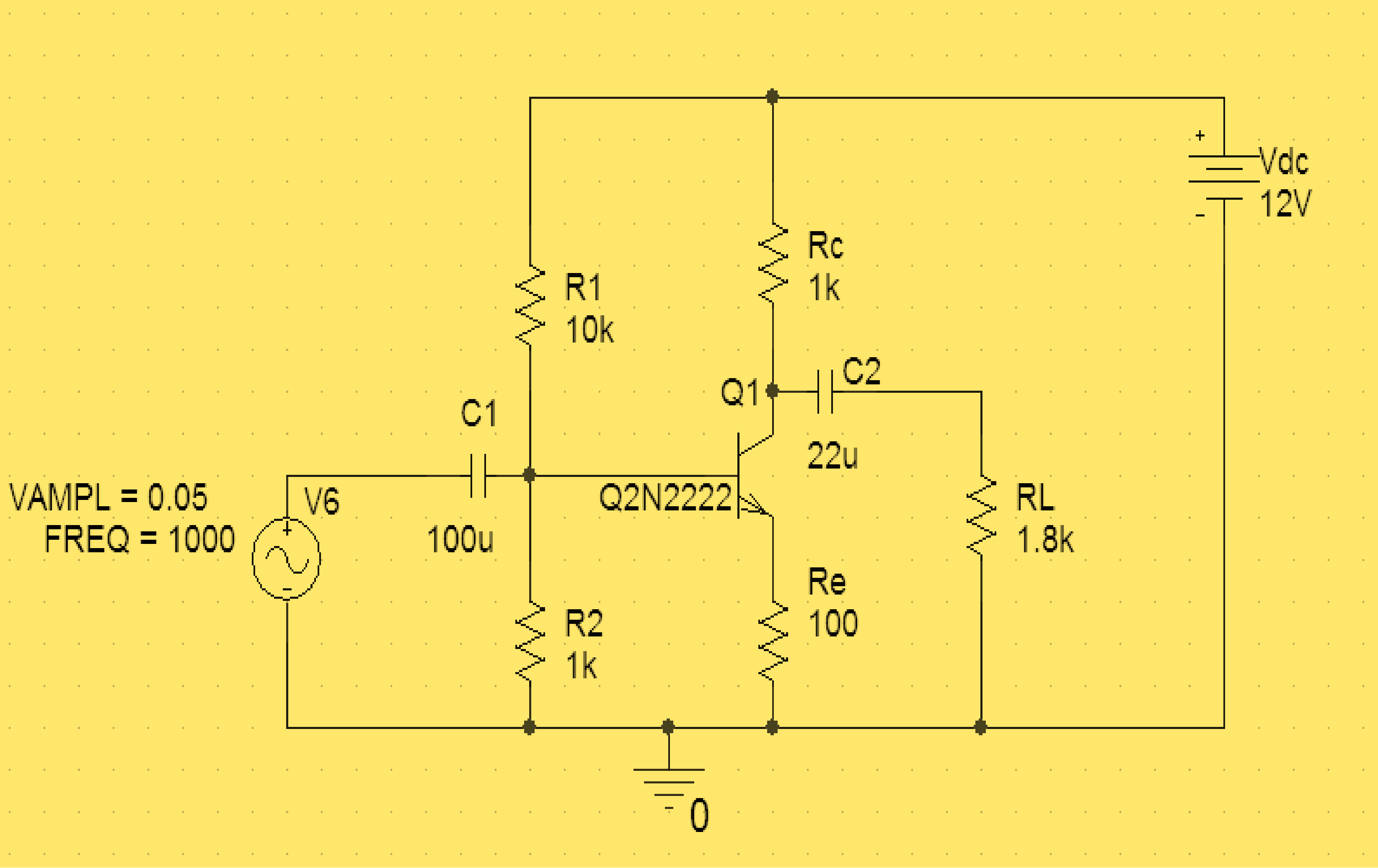
then $A_{vloaded} = A_{vnl}$


V1
12V
0
R1
10k
Rc
1k
C7
Q1
22u
C1
R10
1000k
VAMPL = 0.05
FREQ = 1000
V6
100u
Q2N2222
0
R2
1k
0
100
Re
0



$$Avnl = \frac{Vo}{Vi} =$$

With 1.8k load



Results:

[1] Calculation:

$$A_{nl} = -\frac{\mathrm{Rc}}{\mathrm{Re}} = -10 \ \text{(From re model)}$$

$$A_{vloaded} = \frac{R_l}{R_{l+}Z_o} * A_{vnl}$$

$$= \frac{1.8}{1.8+1} * 10 = 6.428 \quad ,,, \text{where } \mathrm{Zo} = \mathrm{Rc}$$

Results:

[2] Practical:

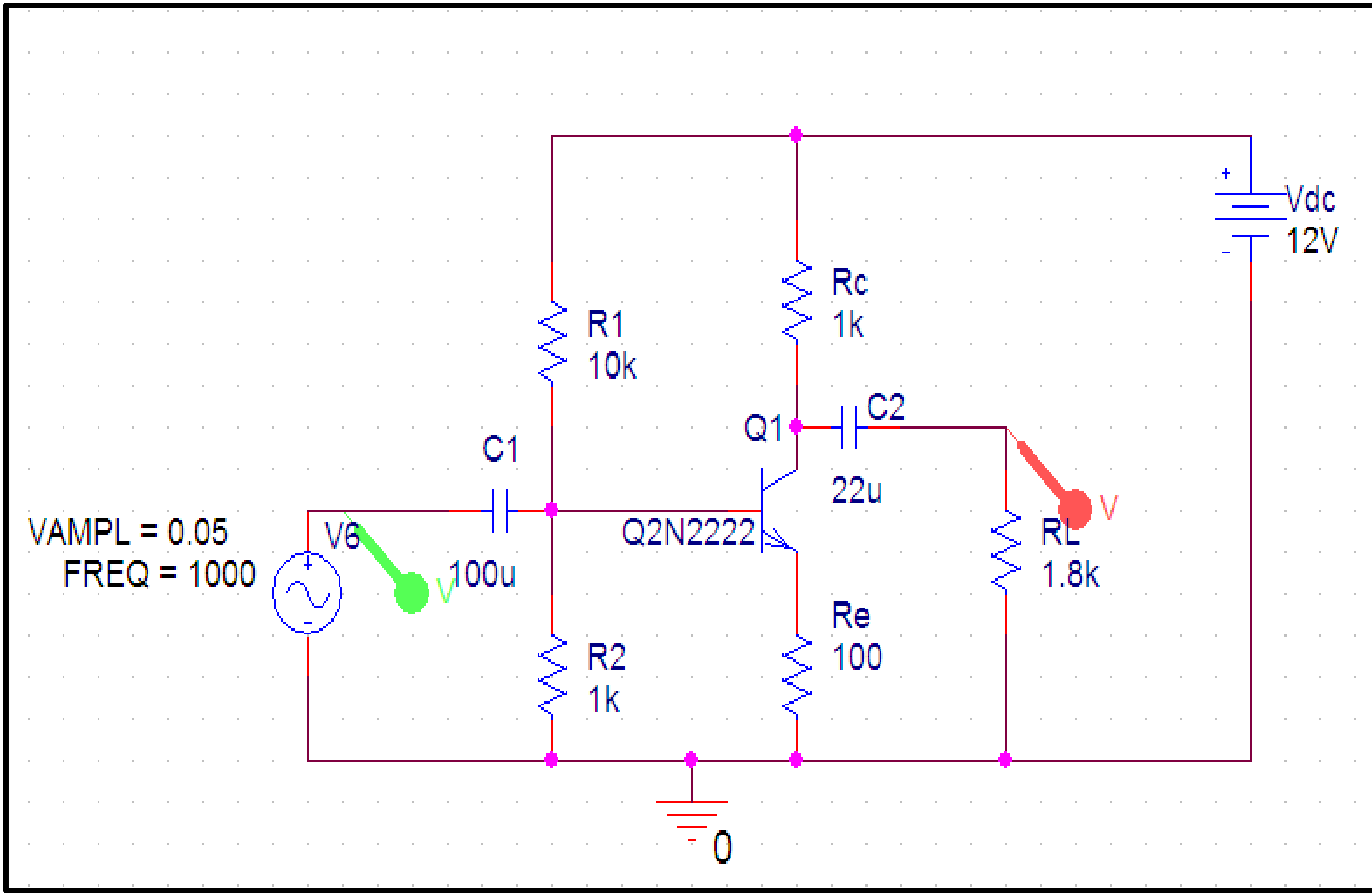
(A) Using Multimeter to measure Vi & Vo

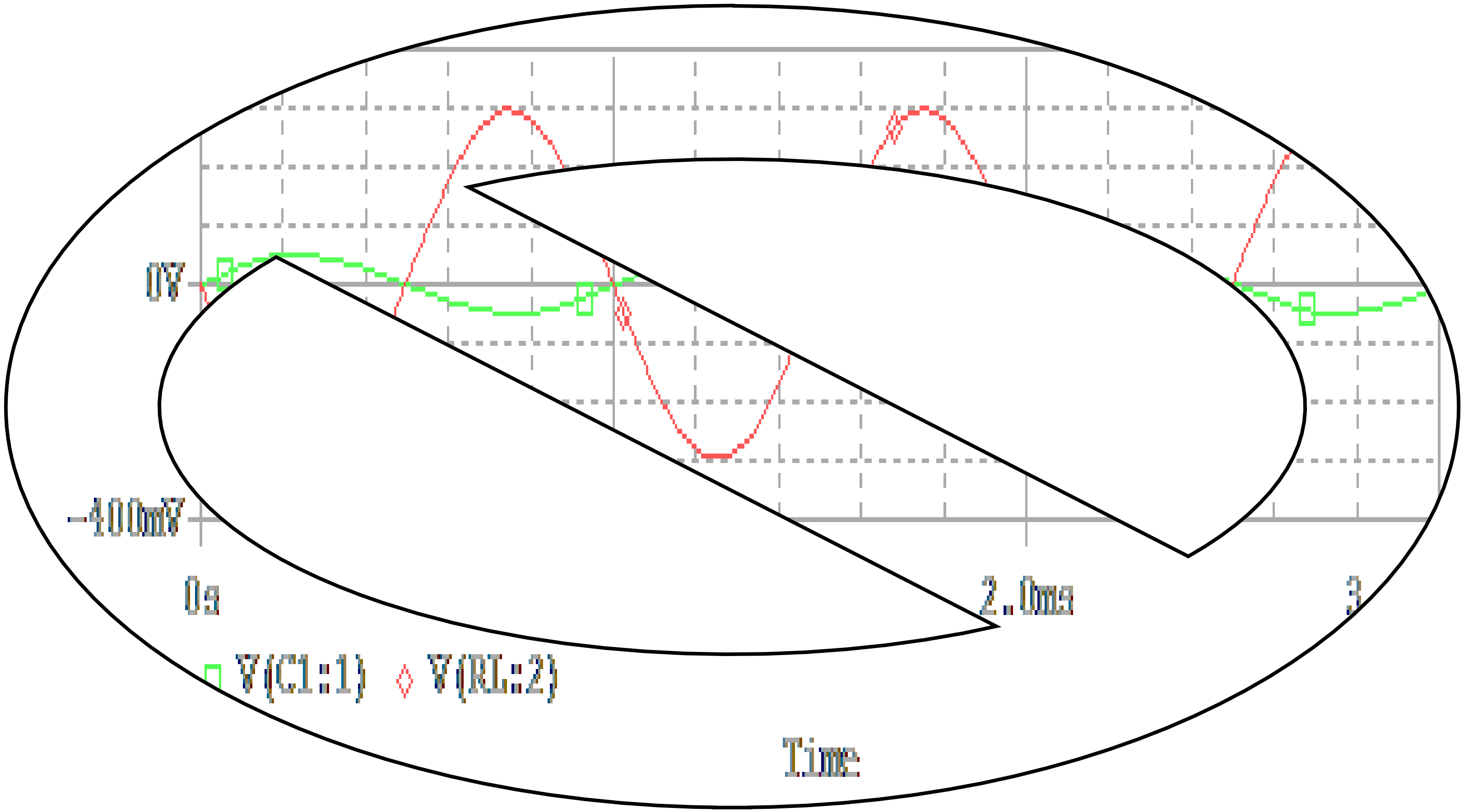
$$A_{loaded} = \frac{Vo}{Vi} =$$

(B) Using Oscilloscope to display Vi & Vo

Results:

[3] Simulation (Orcad 9):

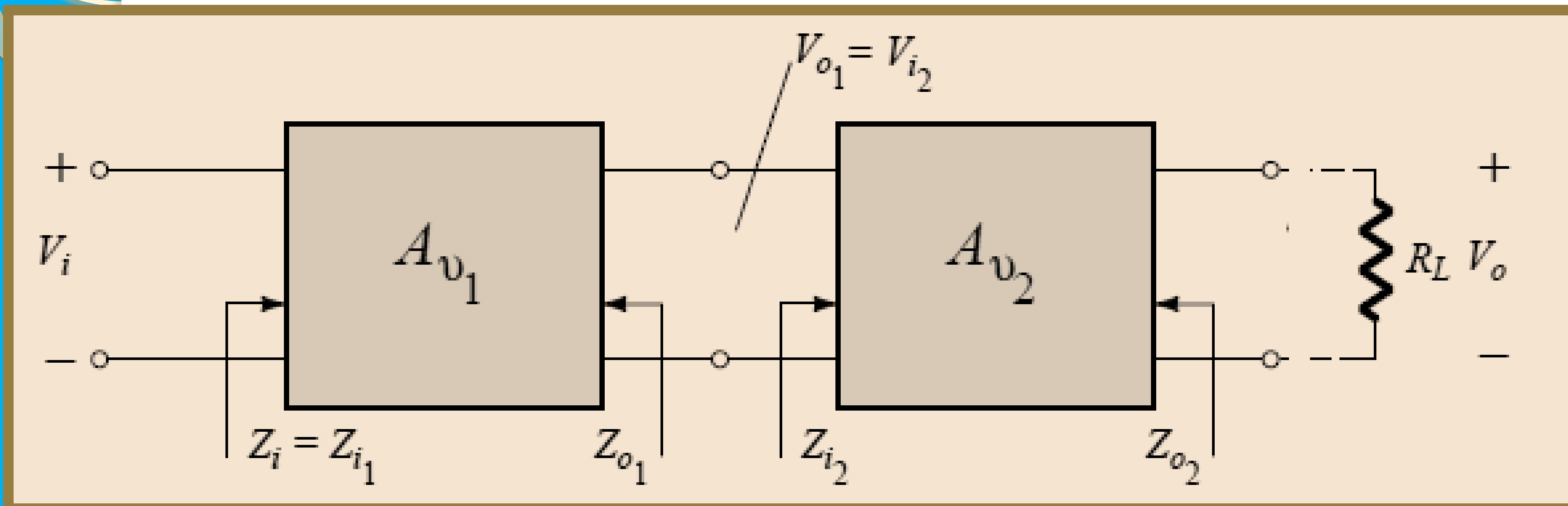




$$A_{loaded} = \frac{Vo}{Vi} =$$

Part Two
Two stage BJT Amplifier

Part Two: Two stage BJT Amplifier



Cascade connection :

In which each stage is coupled with the next by a capacitor.

(I) With no load

[1] Calculation:

$$A_{vnl(tot)} = A_{vloaded(1)} * A_{vnl(2)}$$

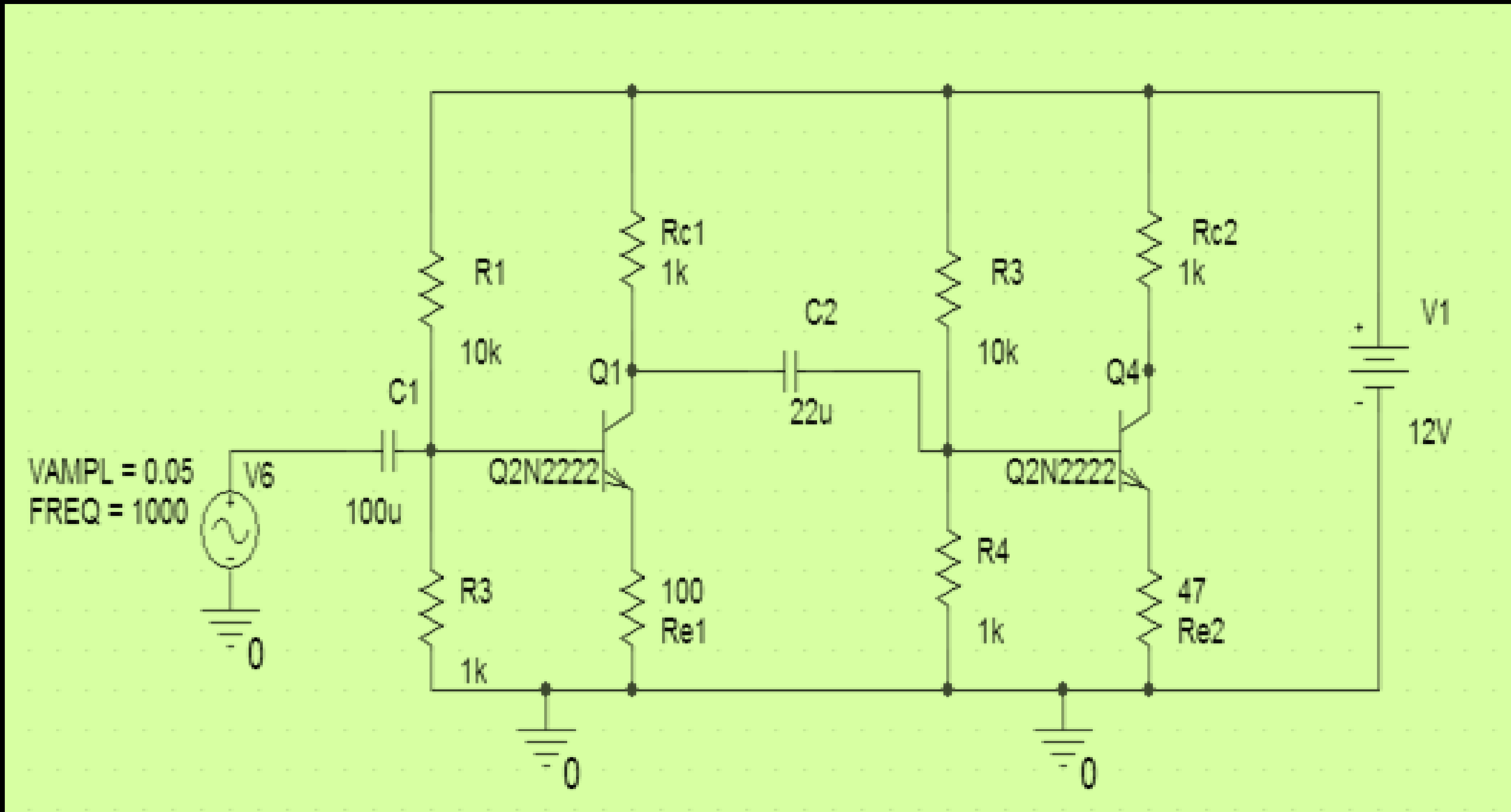
$$= \left(\frac{Z_{in2}}{Z_{in2+}Z_{o1}} A_{vnl(1)} \right) * A_{vnl(2)}$$

$$Z_{o1} = R_c = 1k\Omega$$

$$Zi2 = RB1 // RB2 // \beta(re + \mathrm{Re}) =\sim 0.8k\Omega$$

$$A_{vnl(tot)} = \left(\frac{0.8}{0.8+1} A_{vnl(1)} \right) * A_{vnl(2)}$$

$$= 0.44 * 10 * 21.276 = 94.56$$



R1
10k
Rc1
1k
C2
22u
R3
10k
Rc2
1k
V1
+
-
12V
Q1
Q4
C1
100u
VAMPL = 0.05
FREQ = 1000
V6
Q2N2222
Q2N2222
R3
1k
100
Re1
R4
1k
47
Re2
0
0
0

Results:

[2] Practical:

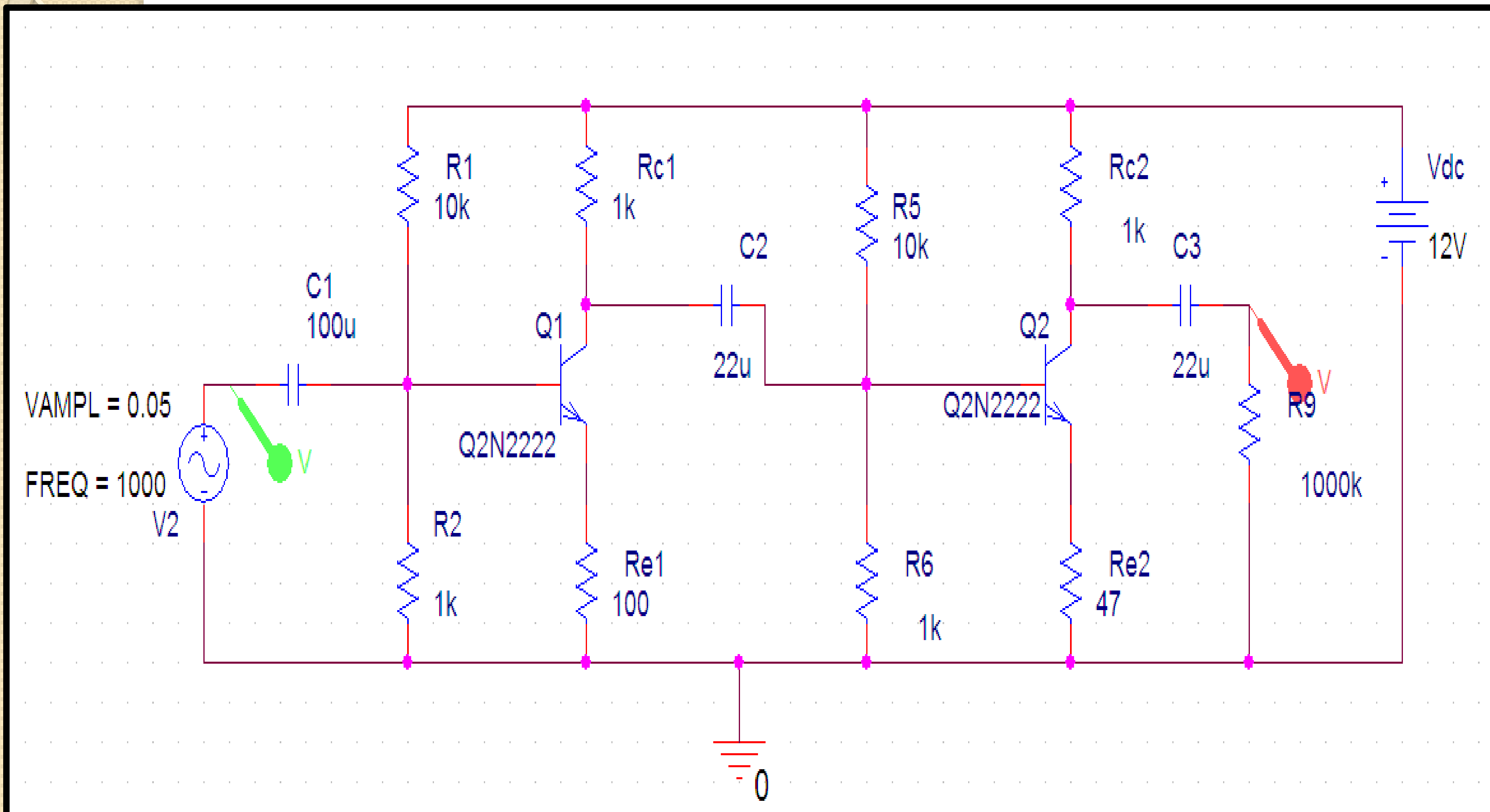
(A) Using Multimeter to measure Vi & Vo

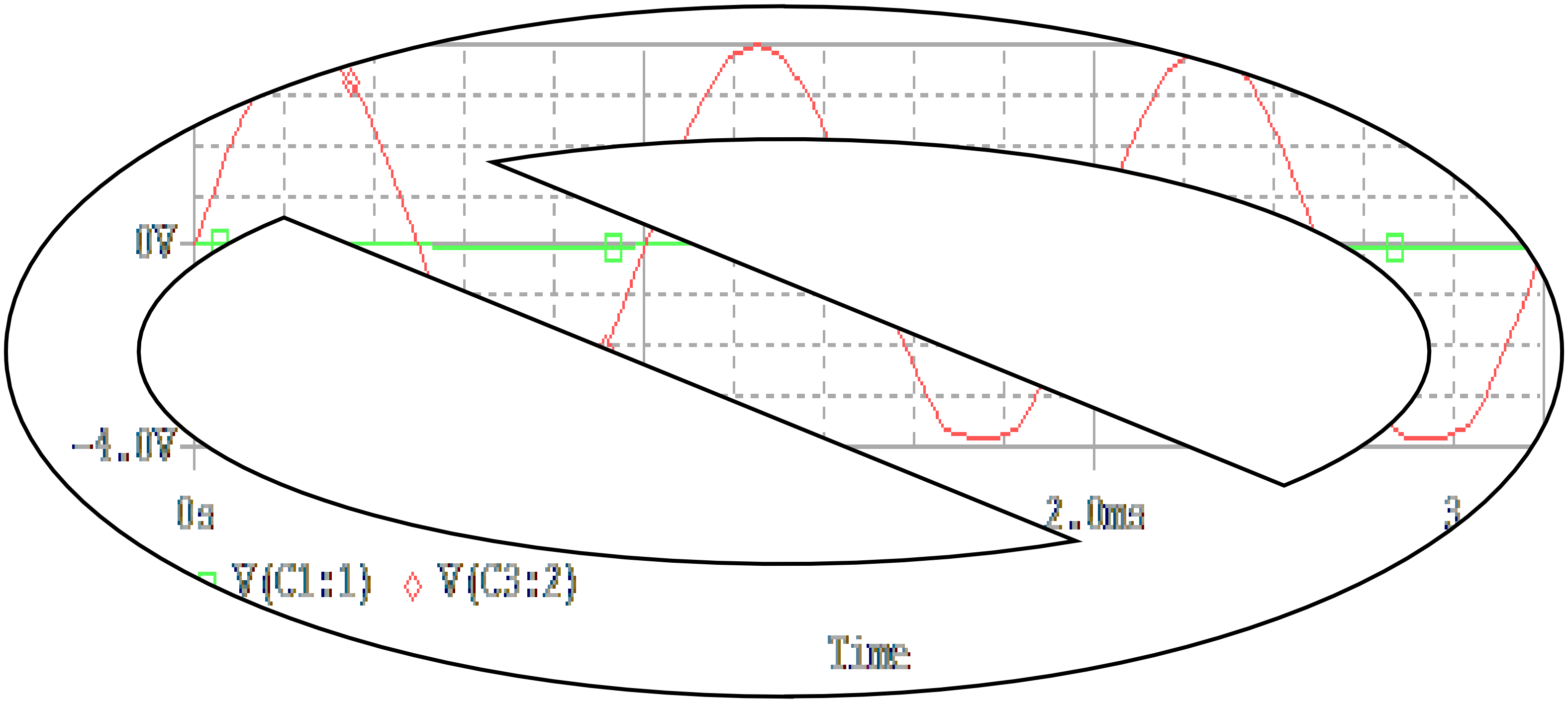
$$A_{nl(tot)} = \frac{Vo}{Vi} =$$

(B) Using Oscilloscope to display Vi & Vo

Results:

[3] Simulation (Orcad 9):





$$A_{vnl(tot)} = \frac{Vo}{Vi} = ?$$

(1) With 1.8k load

[1] Calculation:

$$A_{vloaded\,(tot)} = A_{vloaded\,(1)} * A_{vloaded\,(2)}$$

$$= \left(\frac{Z_{in2}}{Z_{in2+}Z_{o1}} A_{vnl\,(1)}\right) * \left(\frac{R_L}{R_{L+}Z_{o2}} A_{vnl\,(2)}\right)$$

$$= \left(\frac{0.8}{0.8+1} *10\right) * \left(\frac{1.8}{1.8+1} *21.276\right)$$

$$= 60.7$$

$$Z_{o1} = R_c = 1k\Omega$$

$$Zi2 = RB1 // RB2 // \beta(re + \mathrm{Re}) =\sim 0.8k\Omega$$

Results:

[2] Practical:

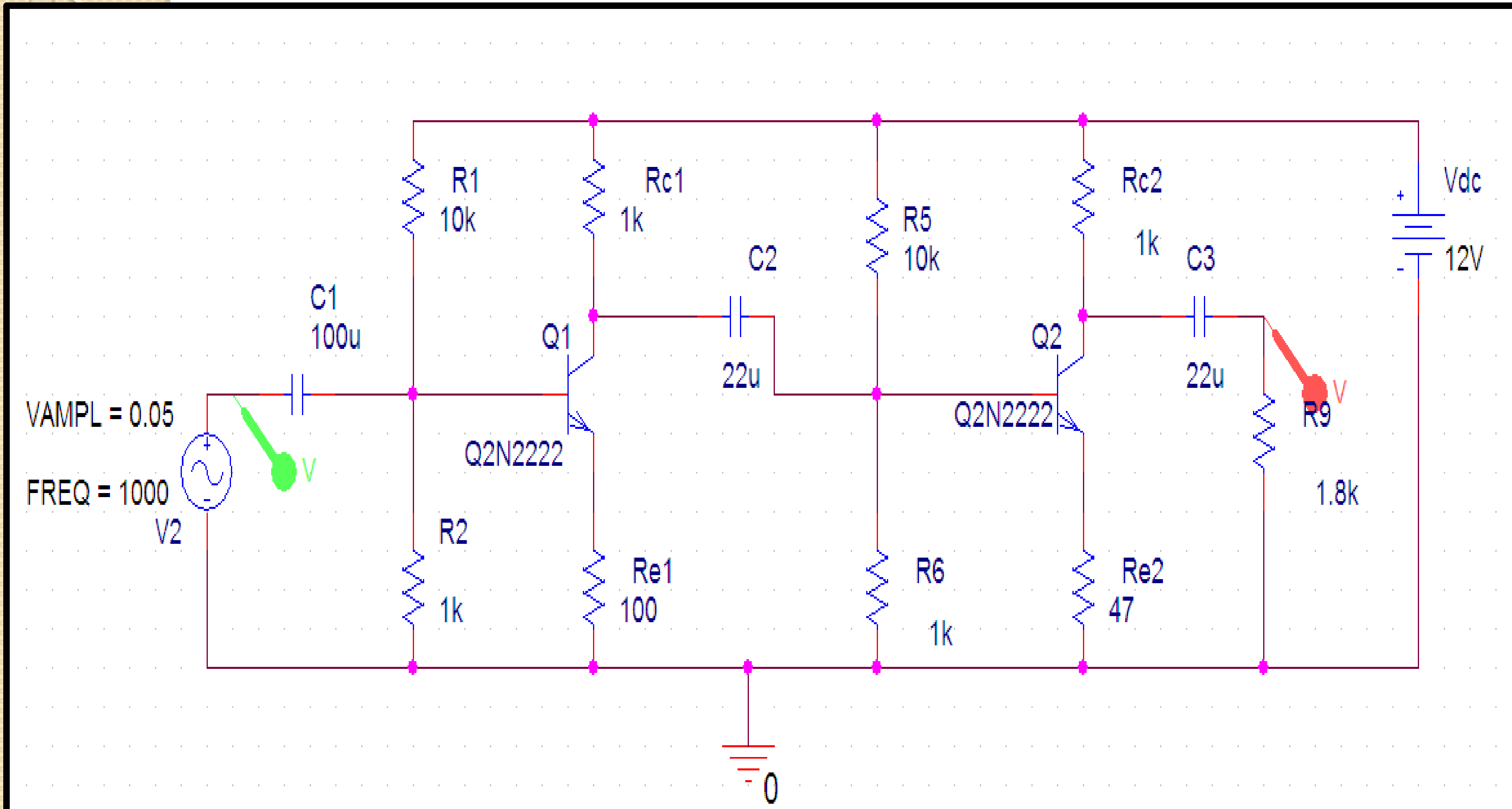
(A) Using Multimeter to measure Vi & Vo

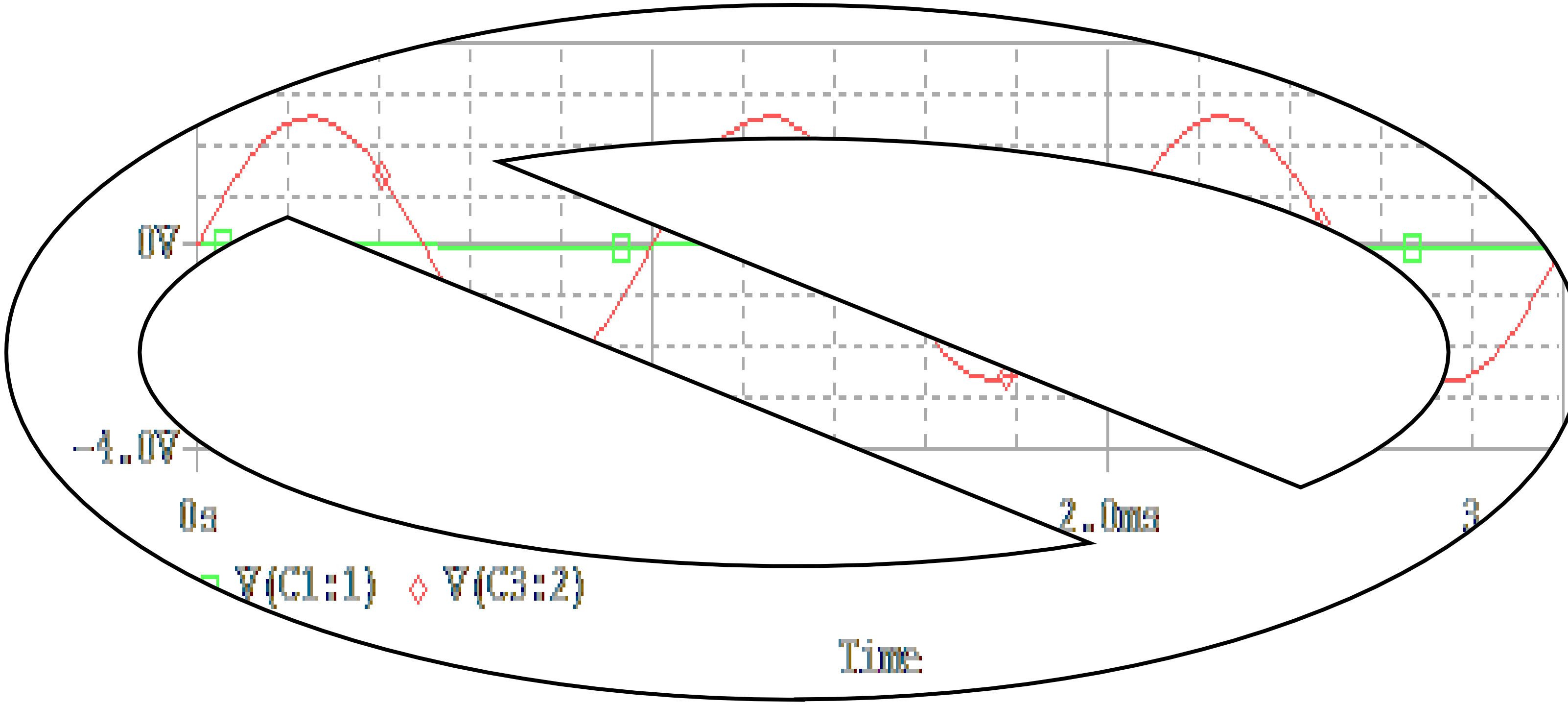
$$A_{loaded\,(tot)} = \frac{Vo}{Vi} = ?$$

(B) Using Oscilloscope to display Vi & Vo

Results:

[3] Simulation (Orcad 9):





$$A_{loaded(tot)} = \frac{Vo}{Vi} = ?$$

Thank You !